TRANSPOWER

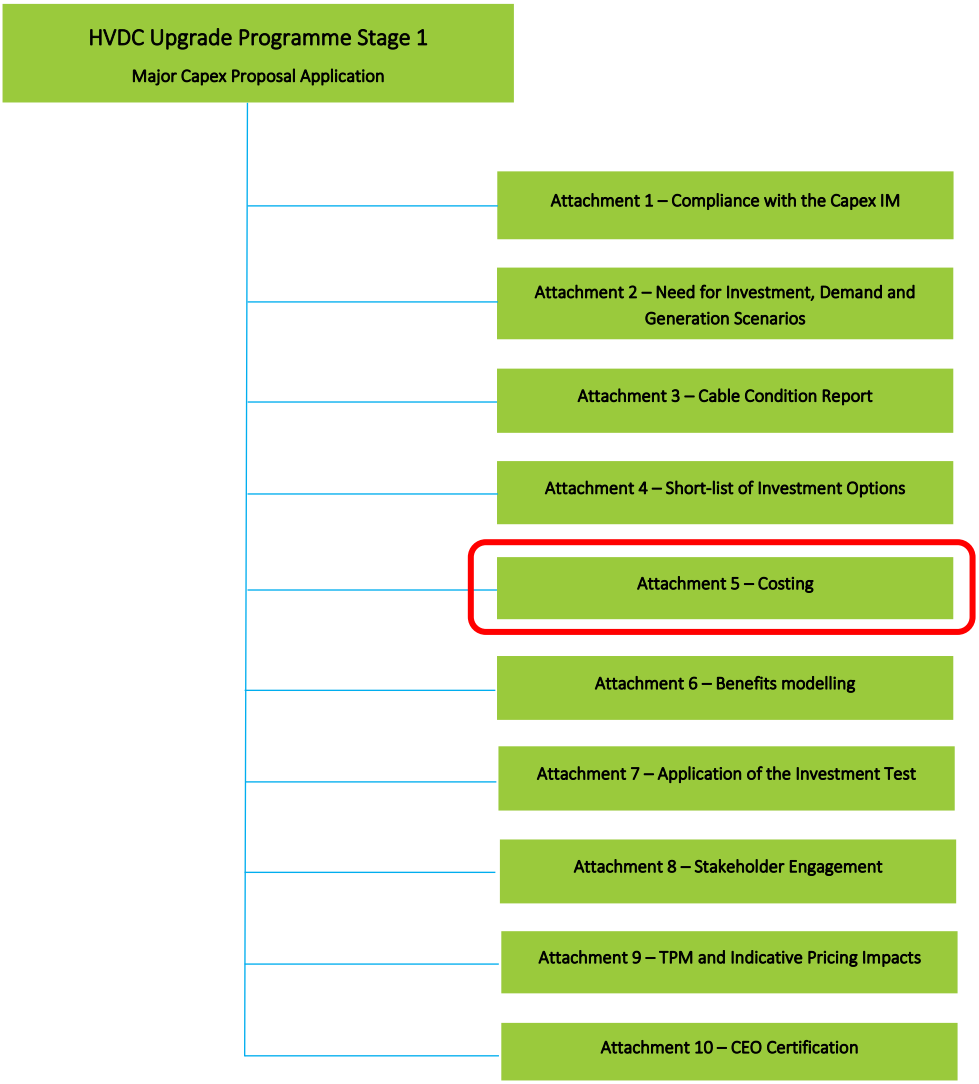
HVDC Link Upgrade Programme Major Capex Proposal (Stage 1)

Attachment 5: Costing

September 2025

Purpose

This attachment provides an overview of our preparation of cost estimates for the HVDC Link Upgrade Programme Stage 1 Major Capex Proposal (**MCP**). It focuses on how we have assessed the capex project costs[1] of the investment options and the major capex allowance (**MCA**) of the proposed Stage 1 investment.



[1] Under the Capex IM, an investment option's project cost includes both capital costs (the focus of this attachment) and operating and maintenance (O&M) costs associated with the investment option. We explain how we have estimated O&M costs associated with each investment option in section 3.1 of Attachment 7 (Application of the Investment Test). We are not seeking an allowance for O&M costs for the proposed Stage 1 investment.

Contents

1 Approach to estimating capex

We use Transpower's Enterprise Estimating System (**TEES**) to estimate the cost of all capex projects.

TEES produces cost estimates for a project based on the historical rates from past projects, known current rates and/or rates from tenders. It also takes account of information from consultants and/or potential vendors (e.g. concept design and solution study exercises).

It also factors in changes in foreign exchange rates and costs of key commodities such as external labour, copper, steel and aluminium.

TEES provides several key benefits:

- Instant access to the best available, up-to-date information for all users,
- The ability to apply cost escalation (commodity input prices and exchange rates),
- Consistency of cost estimation across the business,
- Easy updates incorporating lessons learned from past projects,
- High quality and detailed spend forecasting capability (spend curves which determine when spend will occur over the project duration),
- Links to and interfaces with key cost forecast information in Transpower's financial management system (FMIS),
- An opportunity to include environmental, legal, property and stakeholder costs,
- An opportunity to include a risk adjustment – to account for cost uncertainty not represented in our lower and upper bound estimates.

This structured approach ensures that our capex estimates are accurate, consistent, and reflective of real-world conditions.

1.1 Our cost estimates are P50 values

The capital cost estimates used in the Capex IM investment test (**Investment Test**) and for determining the proposed MCA are P50 estimates.

This means there is an equal probability (50%) that the actual cost will be higher or lower than our estimate; and for risk adjustment and estimate variability, we take a probabilistic approach:

- for all capex categories except risk items, a probability distribution is assigned based on similar projects' performance against estimates;
- each identified risk item is assigned a probability of occurrence;
- each risk item is modelled as having an independent binomial probability of occurrence (unless a specific correlation is identified);
- each risk item is modelled with the distribution of costs if the risk occurs;
- a Monte Carlo simulation is run to combine all probability distributions and produce the overall estimate distribution;
- the Monte Carlo simulation results provide the risk adjustment and determine the P50 estimate value; and
- the simulation results provide the P30 and P70 estimate values to define the major capex adjustment thresholds.

Our capital cost estimates are expressed in real 2025 NZ dollars. To calculate the (nominal) MCA, we apply:

- inflation (CPI) adjustments to reflect expected cost increases over time;
- real price effects to reflect escalation in input costs (over and above CPI) due to market conditions or supply chain factors; and
- interest during construction (**IDC**) to account for financing costs.

This structured approach ensures our estimates are transparent, probabilistically sound, and aligned with industry best practices.

2 Capital cost categories

In Table 1 we describe the high-level capital cost categories used in this MCP.

Table 1: Capital cost category descriptions

Building	Building construction costs including new control room and relevant costs such as heating and ventilation services, fire services, electrical services.
Cable works	Cable works include all costs associated with the supply, installation and install of both underground and subsea cables. This covers trenching, commissioning, and the preparation of as-built documentation. The category also accounts for potential delays (e.g. ship or ROV-related), and support provided by service providers for cable unloading.
Civil works	Civil works encompass all costs related to the construction of foundations, accessways, and other supporting infrastructure required for the installation and commissioning of the Primary Plant. This includes associated civil activities such as earthworks, installation of underground services and drainage, as well as site restoration following construction.
Community Care Fund	Transpower's Community Care Fund supports local projects in communities directly affected by Transpower's HVDC link project.
Design	Design costs are the costs for detailed design and the technical studies required to implement the works. This category includes consultant support (e.g. environmental, noise) and commissioning consultants.
Environmental costs	Environmental costs include all expenses incurred to meet regulatory and project-specific environmental obligations. This may cover compliance activities and approvals required to ensure the project aligns with environmental standards.
Financial costs	Financial costs include bond and financing expenses.
Freight	Freight costs cover the delivery of physical assets to the site.
Investigation	Investigation costs encompass activities related to progressing the preferred solution and developing this Major Capex Proposal (MCP), including conducting a detailed bathymetric survey of the proposed cable routes.
Overheads consultants and contractors	Overhead costs include Transpower staff and contractor overheads necessary for project delivery, such as insurance, project management, and health and safety planning. This category also covers owner's professional support services and related insurance expenses.
Legal	Legal costs include all required legal expenses for the project.

Miscellaneous works	Miscellaneous works include any associated project costs not covered elsewhere such as spares, market costs for testing, decommissioning costs and allowance for other miscellaneous works.
Primary plant works	Primary plant works are the costs of primary plant supply and installation as well as associated equipment such as circuit breakers and bus modifications.
Property	Property costs include expenses related to land and easements.
Risk allowance	Risk allowance represents the budgeted provision for potential risks identified and quantified through a thorough risk analysis process.
Secondary works	Control, protection, and communication systems supporting HVDC link operations including the design, installation and commissioning of SCADA, and other commissioning activities with final As-Built documentation
Storage facility works	Storage facility works include infrastructure related to spare cable storage, such as the installation of cable turntables and turntable hold-down systems.

3 Project costs

3.1 Proposed investment project costs

The capex project cost for Option 3 (the proposed investment) as used in the Investment Test is presented in Table 2, with breakdowns detailed in Tables 3 to 10. Table 11 shows the total project cost for the proposed investment as used in the Investment Test, which is the sum of the capex and O&M project costs[2] for the proposed investment.

Table 2: Proposed investment (Increased capacity, Option 3) capital cost estimate

Stage	Capital cost category	Estimated P50 cost ($m, real 2025)
Stage 1	Supply and installation of four new submarine cables to support 1400 MW north	760.4
Stage 1	Cable termination stations replacements	134.5
Stage 1	Benmore filter bank to enable 1400 MW	19.7
Stage 1	Pole 2 overload scheme	12.7
Stage 1	Establishment of new submarine cable storage facility	11.6
Stage 1	Project investigation costs	19.5
Stage 2	HVDC Control System replacement	253.5
Stage 2	Recovery and disposal of decommissioned existing submarine cables*	131.8
Stage 2	Provision for recovery and disposal of new submarine cables	131.8
	Capex project cost	**1,475.4**

* Likely to be treated as consequential opex

While capex project cost estimates for the Stage 2 items are included as they form part of the proposed investment and are included in the Investment Test analysis, they are not yet sufficiently developed to be included in the proposed Stage 1 investment or MCA. We will continue to refine these estimates by engaging with the market and further analysing the scope and requirements for both the control system replacement and cable recovery and

2 See footnote 1 above.

disposal. Once robust cost estimates are available, we intend to submit a subsequent stage application to the Commerce Commission to seek approval for cost recovery for these works.

3.1.1 Option 3 (Proposed Investment) TEES cost breakdown

Table 3: Supply and installation of four new submarine cables, 1400 MW

Capital cost category	Estimated P50 cost ($m, real 2025)
Cable works	414.1
Design	43.0
Overheads	141.5
Miscellaneous works	22.1
Risk allowance	123.2
Investigation	9.5
Civil works	2.0
Property	2.0
Environmental costs	1.0
Community Care Fund	1.5
Financial costs	0.5
Total P50 Cost (capex)	**760.4**

Table 4: Cable termination station replacement

Capital cost category	Estimated P50 cost ($m, real 2025)
Civil works	5.9
Building	87.7
Miscellaneous works	2.0
Primary plant works	3.8
Design	7.9
Overheads	16.9
Risk allowance	10.2
Total P50 Cost (capex)	**134.5**

Table 5: Benmore filter bank

Capital cost category	Estimated P50 cost ($m, real 2025)
Civil works	0.6
Primary plant works	10.8
Freight	0.2
Design	2.3
Overheads	3.4
Risk allowance	2.4
Total P50 Cost (capex)	**19.7**

Table 6: Pole 2 overload scheme

Capital cost category	Estimated P50 cost ($m, real 2025)
Primary plant works	5.2
Design	1.0
Overheads	3.6
Risk allowance	2.9
Total P50 Cost (capex)	**12.7**

Table 7: New cable storage facility

Capital cost category	Estimated P50 cost ($m, real 2025)
Civil works	0.9
Building	0.9
Design	0.7
Overheads	2.5
Property	0.2
Storage facility works	5.0
Risk allowance	1.4
Total P50 Cost (capex)	**11.6**

Table 8: HVDC control system replacement

Capital cost category	Estimated P50 cost ($m, real 2025)
Secondary works	[redacted]
Overheads	
Risk allowance	
Miscellaneous works	
Total P50 Cost (capex)	**253.5**

Table 9: Recovery and disposal of decommissioned existing submarine cables*

Capital cost category	Estimated P50 cost ($m, real 2025)
Miscellaneous works	[redacted]
Freight	
Overheads	
Risk allowance	
Total P50 Cost (capex)	**131.8**

*This item is likely to be treated as consequential opex

Table 10: Provision for recovery and disposal of new submarine cables

Capital cost category	Estimated P50 cost ($m, real 2025)
Miscellaneous works	[redacted]
Freight	
Overheads	
Risk allowance	
Total P50 Cost (capex)	**131.8**

Table 11: Project cost of the proposed investment

Cost category	P50 cost ($k, real 2025)
Capex project cost	1,475.4
O&M project cost	720.0
Total project cost	**2,195.4**

3.2 Base case (Option 1) and Option 2 project costs

Project cost estimates for the base case (Option 1) and Option 2 are provided in Appendix A.

4 Major Capex Allowance

If cost recovery for the proposed investment is approved by the Commerce Commission, the Commerce Commission will also approve a maximum expenditure amount for the project, being the Major Capex Allowance (MCA) and/or a Maximum Recoverable Cost (if there is an allowance for non-transmission solution opex or consequential opex). The costs of the project will be recovered from Transpower's customers through regulated transmission charges (see Attachment 9).

The MCA is based on our P50 estimate of project costs for the proposed Stage 1 investment[3], meaning there is an equal chance that nominal capex (including CPI and escalation) plus IDC for the proposed Stage 1 investment will be higher or lower than the MCA.

Some commodities relevant to this project have historically experienced price increases that exceed general inflation (CPI), driven by market conditions and supply chain factors. To reflect these real price effects – i.e., cost escalation in input materials beyond CPI – we have included a real escalation adjustment (over and above CPI).

This adjustment has been derived from a 5-year weighted average of historic real cost escalation for key materials and components relevant to the project. These real price effects capture pressures such as global demand shifts, constrained supply chains, and material-specific market trends. The resulting weighted average has been used to forecast real escalation over the duration of the project.

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3 This excludes the control system replacement and the recovery of decommissioned submarine cables as these are not included in Stage 1. We anticipate seeking an allowance for these works as part of Stage 2.

By including this real escalation in our capex forecasts, we aim to ensure that the MCA reflects likely future cost conditions more accurately, helping to mitigate the risk of underestimation and ensuring sufficient allowance is available to deliver the project as planned.

Table 12 provides a summary of our MCA calculation which includes adjustments for inflation, real price effects (escalation) and IDC, along with an annual expenditure breakdown.

Table 12: Derivation of MCA and annual allocation, $m

	2025	2026	2027	2028	2029	2030	2031	Total
Capex (real 2025)	26.9	65.2	38.6	62.0	189.3	188.3	407.7	978.1
Inflation	0.1	0.8	0.9	1.7	3.9	11.6	32.1	51.2
Escalation	0.0	0.2	0.2	0.5	1.1	3.2	8.9	14.1
Capex (nominal)	27.0	66.3	39.8	64.2	194.3	203.1	448.6	1,043.4
Interest during construction (IDC)	0.3	3.0	5.8	8.8	15.7	24.3	37.3	95.2
Major Capex Allowance (MCA)								**1,138.6**

4.1 Major Capex Adjustments

As with any project, and consistent with the incentive regime, we will attempt to deliver this project as efficiently as possible. We propose this project use the default major capex incentive rate of 15% for calculation of the major capex expenditure and output adjustment under the Capex IM.

If capex for a major capex project is between the P30 and P70 estimates of total project cost, the major capex expenditure and output adjustment is zero. Table 13: 14provides a summary of the P30 and P70 estimates for the proposed investment.

Table 13: 14P30, P50 & P70 Estimates, $m

	P30	P50	P70
Total project cost (real 2025)	911.9	978.1	1,069.2
MCA (nominal)	1,049.6	1.138.6	1,262.7

4.2 Proposed Stage 1 major capex project outputs

Table 14 summarises the expected capital cost and resulting MCA relating to the proposed Stage 1 major capex outputs.

We are not seeking approval for the control system replacement or cable recovery works as part of the proposed Stage 1 investment. We intend to seek approval for the control system replacement and cable recovery works as a future stage once we have confirmation of scope and cost.

Table 14: 15Proposed Stage 1 major capex project outputs

Investment	Expected P50 cost (real 2025 $m)	MCA (incl. inflation, escalation, IDC $m)	Expected commissioning/ delivery date
Supply and installation of four new submarine cables to support 1400 MW north	760.4	871.0	2031
Cable termination stations replacements	134.5	161.7	2031
Benmore filter bank to enable 1400 MW	19.7	23.8	2031
Pole 2 overload scheme	12.7	15.6	2031
Establishment of new submarine cable storage facility	11.6	14.1	2031
Project investigation costs	19.5	26.3	2031
Stage 2 preparatory costs	19.6	26.1	
Total	**978.1**	**1,138.6**	

While the HVDC control system replacement and the recovery of the decommissioned 1990s submarine cables are included in the proposed investment and Investment Test analysis, we do not yet have sufficiently detailed cost estimates to include these works in the MCA or as Maximum Recoverable Costs (consequential opex).

We will continue to investigate the requirements for the control system and engage with the market to refine our understanding of its scope and cost. Similarly, we plan to undertake further analysis of the cable recovery work to better define the associated scope and costs. We have included preparatory costs to undertake these investigations in preparation for Stage 2 as part of our MCA.[4] This will include engagement with international control system suppliers to support the development of the required scope and cost.

Once robust cost estimates are available, we intend to submit a subsequent stage MCP to the Commerce Commission covering these works.

[4] The preparatory costs for Stage 2 will be held as works-under-construction until there is a Stage 2 asset into which they can be capitalised.

5 Proposed Stage 1 investment at a glance

Table 1516: Stage 1 Proposal at a glance

HVDC Link Upgrade Programme MCP (Stage 1) at a glance	
What:	Ensure a reliable and resilient electricity supply that meets growing demand by addressing risks linked to the aging condition of the HVDC submarine cables and associated infrastructure. We will achieve this through the following outputs: • procure, install and commission four new HVDC submarine cables, increasing the HVDC link's transfer capacity north from 1200 MW to around 1400 MW; • construct and commission new cable termination stations and associated equipment located at Oteranga Bay (North Island) and Ōraumoa Fighting Bay (South Island), along with necessary modifications to the existing overhead line connections; • procure, construct and commission an additional filter bank at Benmore substation to facilitate continuous operation at the increased capacity of around 1400 MW; • works to increase the Pole 2 overload capacity at Haywards and Benmore; • construct and commission a new submarine cable storage facility and associated infrastructure and equipment to house spare cable lengths for future maintenance and repairs; and • preparatory work for a potential Stage 2, including early engagement with vendors and suppliers to refine scope and confirm cost estimates for anticipated future stage projects.[5] Each of the four new submarine cables will be approximately 40km in length and installed within designated cable routes in the Cook Strait Cable Protection Zone (CPZ). They will connect to the upgraded termination stations.
When:	Commence work as soon as funding is approved Commissioning date assumption (commissioning date of last Stage 1 investment): 31 December 2031
How much:	Major Capex Allowance: $1,138.6 million.
Incentive elements:	Major capex incentive rate: Default rate of 15%
Approval expiry date:	31 December 2036[6]

5 Capex for the preparatory work will be held as works-under-construction until there is a Stage 2 asset in which to capitalise it.

6 We propose an approval expiry date be 31 December 2036, being five years after the commissioning date assumption. We have proposed this extra period because this allows for any unforeseen delay in mobilisation, construction or commissioning that may be caused by unexpected events. If this happens it will be efficient to have a reasonable window during which we will not have to re-apply for investment approval.

Anticipated future stages

The investments outlined in Table 16 are expected to form part of the subsequent stage application, consistent with the analysis underpinning this MCP.

We are not seeking approval for cost recovery for the subsequent stage investments as part of this MCP.

Table 16 17: Anticipated investments for HVDC Link Upgrade Programme future stages

Outputs	Estimated P50 cost ($m, real 2025)	Estimated commissioning/ delivery year
HVDC Control System replacement Designing, procuring, constructing, and commissioning new HVDC control system equipment and facilities at Haywards and Benmore.	253.5	2031
Recovery and disposal of decommissioned existing submarine cables* Recovering and disposing of the three existing 1990s submarine cables after decommissioning.	131.8	2033
Provision for recovery and disposal of new submarine cables In the event that there is a legal obligation to remove the new submarine cables at the end of their useful lives, Generally Accepted Accounting Practice (GAAP), will require a provision to be raised to reflect the future cost of decommissioning, which will increase the value of the new cables. This ensures that the full lifecycle costs are recognised from the outset, rather than being deferred until decommissioning occurs.	131.8	2031

*Likely to be treated as consequential opex

6 Project requirements and project management approach

6.1 Project requirements

At a high level, the works required to complete the installation of new undersea HVDC cables include:

- Regulatory approvals, including regional council resource consents and maritime authorities (as required);
- Cable transport logistics, including sea freight, storage, and handling at cable landing sites;
- Landside civil works, such as horizontal directional drilling, duct installation; transition joint bays, and cable trenching;
- Marine cable laying operations to enable cable installation;
- Onshore cable installation, including jointing and termination at new cable terminations;
- Works on the secondary and protection systems;
- Station services integration, such as power supplies, HVAC, and fire detection/suppression;
- System testing and commissioning.

At a high level, the works required to construct the new cable termination stations at OTB and FTB include:

- Site investigations and geotechnical assessments, including survey, ground conditions, and environmental constraints;
- Detailed design of the building platforms, structural works, and integration of new cable termination equipment;
- Resource consents and local authority approvals, including earthworks, drainage, and building consents (as required);
- Earthworks and platform construction, drainage, and access;
- Building construction, including structural foundations, enclosure for cable terminations, HVAC, and fire protection;
- Installation of new cable terminations and primary equipment, including interfacing with HVDC submarine cables, and support structures;
- Construct and install new control rooms;
- Installation of secondary systems, such as protection, control, communication panels, and SCADA/HMI interfaces as required;
- Coordination with cable laying activities, including precise alignment, joint bay integration, and testing interfaces;
- Testing and commissioning.

At a high level, the works required to install additional HVDC filter bank include:

- System studies to confirm design requirements;
- Procurement and delivery of filter components Integration with the HVDC control and protection systems design;

- Civil and structural works;
- Assembly and installation of filter equipment, including physical installation, terminations, and earthing of filter elements;
- Installation of associated primary plant and secondary systems integration;
- Secondary systems integration, including protection relays, control wiring, monitoring devices, and communication systems;
- Testing and commissioning.

At a high level, the works required to deliver the Pole 2 overload include:

- Detailed engineering design, including thermal modelling and heat run tests, control logic modifications, and specification of required hardware or upgrades;
- Procurement and fabrication of modification components, such as upgraded cooling systems, control devices, or auxiliary equipment (as required);
- Physical modifications to the converter transformers and valve cooling arrangements, which may include additional or upgraded fans/pumps, radiators, temperature sensors, and tap changer adjustments;
- Integration within the control, protection and market systems;
- Testing and commissioning in conjunction with the cable installation.

At a high level, the works required to construct the new spare cable storage facility include:

- Design and supply of the cable turntable;
- Site investigations and design development, including structural design for the building and turntable support;
- Planning and consenting, including securing necessary building/resource consents;
- Site preparation and civil works, including earthworks, drainage, access improvements, and construction of a level building platform;
- Construction of the cable storage building, including structural foundations, weatherproof enclosure, ventilation, fire protection, lighting, and security systems;
- Installation of the cable turntable, including reinforced base slab, anchoring system, and integration with the building structure and accessways;
- Mechanical and electrical services, including power supply to the turntable, lighting, HVAC (if required), and auxiliary systems;
- Delivery and secure storage of the spare cable and careful placement onto the new turntable;
- Commissioning and operational readiness, including functional testing of the turntable.

6.2 Project management approach

The proposed stage 1 investment will be managed using Transpower's standard project delivery framework, with additional oversight to reflect the size and complexity of this project. Key elements of the approach include:

- Governance oversight;
- Project planning and scheduling;
- Contract management;
- Cost and risk management;

- Technical reviews;
- Performance monitoring and reporting.

Transpower will allocate experienced management and technical resources to:

- Monitor cost performance against budget;
- Track project milestones to ensure timely delivery;
- Ensure the scope and quality of deliverables meet the required standards.

Factors that may affect Transpower's ability to achieve the proposed major capex project outputs include:

- Failure to secure required consents for the project. This is typically outside of Transpower's control. Transpower has significant experience in council and RMA applications. The consenting challenges for the proposed investment are mitigated as the work is happening on an existing substation site, with existing designations;
- Unforeseen changes to electricity market operations limiting our ability to secure the required system outages. This is largely outside Transpower's control, but we consider it highly unlikely to impact this project as we plan and forecast outage requirements to the market in advance;
- Major disruptions to global supply chains impacting our ability to secure internationally sourced materials. This is largely outside of Transpower's control but can be partially mitigated by ensuring long lead-time items are ordered sufficiently far in advance to not impact delivery timelines.

We are actively engaging with iwi and other stakeholders. Cultural, environmental, and regulatory requirements are being integrated into our planning and consenting strategies from the outset. This project is specifically listed in Schedule 2 of the Fast-track Approvals Act 2024, recognising its national significance and enabling us to apply directly for fast-track consenting through an expert panel should we decide to do so. This proactive approach is intended to mitigate potential risks and ensure the project aligns with community expectations, statutory obligations and our social license to operate.

By applying robust project management practices and proactively mitigating risks, Transpower aims to deliver this project on time, within budget, and to the required quality standards.

Appendix A

The project cost estimates for the base case (Option 1) and Option 2 as used in the Investment Test are presented in Tables 17 and 18 below.[7]

Table 17 18: Base case (Option 1) project cost estimate

Capital cost category	Estimated P50 cost ($m, real 2025)
Recovery and disposal of decommissioned existing submarine cables*	131.8
Decommissioning of HVDC line	360.0
Capex project cost	**491.8**
O&M project cost	280.0
Total project cost	771.8

*Likely to be treated as consequential opex

7 See footnote 1 above.

Table 1819: Option 2 project cost estimate

Cost category	Estimated P50 cost ($m, real 2025)
Supply and installation of three submarine cables to support 1200 MW	651.4
Termination station upgrades	132.8
Establishment of new submarine cable storage facility	11.6
Project investigation costs	19.5
HVDC Control System replacement	253.5
Recovery and disposal of decommissioned existing submarine cables*	131.8
Provision for recovery and disposal of new submarine cables	131.8
Capex project cost	**1,332.5**
O&M project cost	720.0
Total project cost	2,052.5

*Likely to be treated as consequential opex

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